2. in line 11 of original Claim 31, the phrase "single and multilayer organic polymers" is limited to the organic polymers that are listed on page 22, lines 10-18;

3. in line 15 of original Claim 31, the phrase "ceramic devices" is deleted;

4. in line 19 of original Claim 31, the phrase "so as to prepare said organic coatings, films, layers, or residues for exposure to sulfur trioxide for facilitating" is replaced by the phrase --capable of facilitating--; and

5. in line 28 of original Claim 31, the phrase "to remove" is replaced by the phrase --capable of removing--.

Claims 11, 14, 18, 20, and 29 are amended to replace "electromagnetic radiation" (which reads on visible radiation) with --ultra-violet radiation--, as was originally recited in these claims.

Attached hereto is a marked-up version of the changes made to Claims 11, 14, 18, 20, 29, and 31 by the current Amendment. The attached page is captioned "**Version with Markings to Show Changes Made**".

Claims 3-23 and 25-31 are rejected under 35 USC 103(a) as being unpatentable over Setterini et al (U.S. Patent 4,363,673).

The Setterini et al reference was extensively discussed in Applicants' previous Amendment filed on August 8, 2000, and Applicants' remarks and arguments made therein obtain here as well. Basically, Setterini et al disclose a method for removing residual carbon, such as from oils and greases, from metal and ceramic (e.g., glass) substrates. In the method, SO_3 is employed, either alone as a gas or liquid, or in combination with other fluids.

The amendments to Claim 31 are listed above.

On June 11, 2001, Applicants' undersigned representative discussed items (2) and (3) above with the Examiner, who indicated at that time that he continued to have difficulty accepting the claims, due to their breadth. The undersigned wishes to express his appreciation for the opportunity to discuss this matter with the Examiner.

The additional amendments to Claim 31, namely, items (1), (4), and (5), are intended to define Applicants' invention with greater specificity. These amendments are an attempt to advance the prosecution and eliminate non-specified aspects, such as listed on page 4 of the Office Action.

Item (1) deletes reference to both photosensitive and non-photosensitive organic materials. As the Examiner correctly notes, all organic materials are one or the other. Instead, Applicants rely on the recitation that the organic coatings, films, layers and residues are selected from the group consisting of polymerized photoresists, paints, resins, single and multilayer organic polymers, organo-metallic complexes, positive optical photoresist, negative optical photoresist, electron-beam photoresists, X-ray photoresists, ion-beam photoresists, ion-implanted photoresists, and other hardened photoresists.

Item (2) specifies the single and multilayer organic polymers that are included in the recitation in Item (1). Such organic polymers, of course, are hardly the oils and greases of concern to Setterini et al.

The recitation of specific organic polymers, which are listed on page 22, lines 10-18 of the specification, is intended to overcome the Examiner's contention on page 4 of the Office Action that the claims "still recited non-specified organic polymers".

Item (3) deletes "ceramic devices". Such deletion is in response to the Examiner's contention on page 4 of the Office Action that the claims "still recite non-specified ceramic devices".

Item (4) emphasizes that the precursor chemical or physical treatment must be --capable of facilitating-- the reaction of SO_3 with the coatings, films, layers, or residues. Clearly, not all chemical or physical treatments are capable of so facilitating the reaction, and these are, of course, not covered by the claims.

Item (5) likewise emphasizes that the chemical or physical post-rinse treatment must be --capable of removing-- any residual organic materials from the substrates remaining after the solvent rinse. Again, clearly, not all chemical or physical treatments are capable of so removing such residual organic materials, and these are, of course, not covered by the claims.

The Examiner contends that the question whether or not the method of Setterini et al would work in the field of microelectronics "is not relevant now, and would not be considered and discussed" (Office Action, page 5). The problem solved is always relevant. For example, as the CCPA stated,

> "For the teachings of a reference to be prior art under 35 U.S.C. §103, there must be some basis for concluding that the reference would have been considered by one skilled in the particular art working on the

> pertinent problem to which the invention pertains; for no matter what a reference teaches, it could not have rendered obvious anything (at the time the invention was made) to a person having ordinary skill in the art to which the subject matter pertains unless that hypothetical person would have considered it."

In re Horn, Horn, Horn, and Horn, 203 U.S.P.Q. 969 (C.C.P.A. 1970).

More recently, the Court of Appeals for the Federal Circuit has stated:

> "In comparing the differences between the structure and the properties taught in the prior art and those of the applicant's invention, there is a need to include consideration of the problems solved by the inventor. The determination of whether a novel structure is or is not obvious requires cognizance of the properties of that structure and the problem that it solves, viewed in the light of the teachings of the prior art. Where the invention for which a patent is sought solves a problem that persisted in the art, one must look to the problem as well as to its solution if he is to appraise properly what was done and to evaluate it against what would be obvious to one having the ordinary skills in the art."

In re Newell, 13 U.S.P.Q.2d 1248, 1250 (Fed. Cir. 1989). While the citation is stated in terms of structure, the word "process" could replace "structure" and the final result would be the same, namely, that the determination of whether a novel process is or is not obvious requires cognizance of the properties of that process and the problem that it solves.

The problem solved by the present invention is how to remove, for example, hardened photoresist from a wide variety of substrates employed in various microelectronic devices, such as liquid crystal displays, photoworks, flat-panel displays, printed wiring boards, magnetic read/write heads, thin-film read/write heads, etc. (specification, page 7, line 13 to page 8, line 12.

It is noted that Setterini et al issued in 1982. Certainly, the problem of removing hardened photoresist, for example, is a well-known problem in the field of microelectronics, and until 1991, no adequate solution existed at all. The Gupta et al patent (U.S. Patent 5,037,506), discussed on page 7, line 8 *et seq.* provided a two-step method using gaseous SO_3. However,

the claimed process was limited to specified substrates, and did not provide additional processing steps to aid in the complete removal of organic materials from a broadened range of substrates.

The present invention is directed to first subjecting the organic coating, film, layer, or residue to a precursor treatment to facilitate the SO_3 reaction with the coating, film, layer, or residue, then treating the coating, film, layer, or residue with SO_3, next rinsing with a solvent, and finally treating the organic coating, film, layer, or residue to a post-rinse treatment to remove any residual organic material from the substrate remaining after the solvent rinse.

While it is true that Setterini et al disclose the use of SO_3 to remove oils and greases from metal or glass substrates, such as steel plate or sheet, there is not the slightest disclosure or suggestion of the removal of the type of coatings found in microelectronic processing, nor of the need to pre-condition the coating so as to facilitate the SO_3 reaction, nor of the need to follow up a solvent rinse with an additional step to remove any residues still remaining.

The Examiner makes much of (1) identifying heating and/or flushing with gases such as nitrogen as equivalent to Applicants' precursor step of the need to facilitate the SO_3 reaction and (2) identifying kinetic energy in post rinse treatment as equivalent to Applicants' post-rinse treatment to remove any residues still remaining. These steps, of course, fail to perform the required precursor and post-rinse treatments recited in amended Claim 31.

With the benefit of impermissible hindsight, the Examiner has equated Setterini et al with Applicants' claims. Yet, in all the years since 1982, the semiconductor processing industry failed to adopt the teachings of Setterini et al, clearly intended for bulk surfaces, for the cleaning of considerably smaller surface features. This, of course, is directly contrary to the Examiner's statement on page 4 of the Office Action that it would have been obvious to an ordinary artisan at the time the invention was made that the teaching of Setterini et al, encompass non-specified organic polymers recited in the claims. (These organic polymers are now specified, and obviously are not the oils and greases contemplated by Setterini et al.)

Applicants submit that the claims are patentable over Setterini et al.

In amending Claims 11, 14, 18, 20, and 29 in the previous Amendment, Applicants inadvertently included visible light ("electromagnetic radiation"), without intending to do so. These claims have been amended to re-instate ultra-violet (UV) radiation.

Reconsideration of the rejection of Claims 3-23, 25-29, and 31, as amended, under 35 USC 103(a) as being unpatentable over Settineri et al is respectfully requested.

Applicants appreciate that the Terminal Disclaimer has been accepted.

The foregoing amendments and arguments are submitted to place the application in condition for allowance or in better condition for appeal. The Examiner is respectfully requested to enter this Amendment. If the Examiner has any questions, he is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,

AHMAD (NMI) WALEH ET AL

June 13, 2001

David W. Collins

David W. Collins
Attorney for Applicants
Registration No. 26,857

75 West Calle de las Tiendas
Suite 125B
Green Valley, AZ 85614

Telephone calls may be made to:
(520) 399-3203

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 11, 14, 18, 20, 29, and 31 have been amended as follows:

11. (Twice Amended) The method of Claim 31 wherein said precursor physical treatment is selected from the group consisting of exposure to heat, [electromagnetic] ultra-violet radiation, laser energy, ultrasonic and megasonic sound energy.

14. (Thrice Amended) The method of Claim 31 wherein said solvent rinse is simultaneously carried out in the presence of megasonic or ultrasonic energy, heat, [electromagnetic] ultra-violet radiation, or laser energy.

18. (Thrice Amended) The method of Claim 31 wherein said post-rinse physical treatment is selected from the group consisting of further exposure to heat, [electromagnetic] ultra-violet radiation, laser energy, kinetic energy, high-pressure deionized water sprays, physical scrubbing, CO_2 snow processing, ultrasonic and megasonic sound energy.

20. (Thrice Amended) The method of Claim 31 wherein step (b) further comprises subjecting said organic coatings, films, layers, or residues to simultaneous exposure to a component selected from the group consisting of other chemically active process gases and vapors, chemically inert process gases, vaporized solvents, heat, [electromagnetic] ultra-violet radiation, and laser energy.

29. (Thrice Amended) The method of Claim 25 wherein said pre-rinse physical treatment consists of further exposure to a component selected from the group consisting of heat, [electromagnetic] ultra-violet radiation, laser energy, kinetic energy, high-pressure deionized water sprays, physical scrubbing, CO_2 snow processing, ultrasonic and megasonic sound energy.

31. (Once Amended) An improved method for partially or completely removing organic coatings, films, layers or residues from a substrate, said method comprising:

(1) subjecting said organic coatings, films, layers, or residues to a vapor consisting essentially of water-free gaseous sulfur trioxide for a period of time, said substrates being maintained at a temperature in the range from about room temperature to 400°C; and

(2) subjecting said organic coatings, films, layers, or residues to a solvent rinse;

wherein the improvement comprises the following steps:

(a) providing organic coatings, films, layers and residues that are [either photosensitive or non-photosensitive organic materials and are] selected from the group consisting of polymerized photoresists, paints, resins, single and multilayer organic polymers, organo-metallic complexes, positive optical photoresist, negative optical photoresist, electron-beam photoresists, X-ray photoresists, ion-beam photoresists, ion-implanted photoresists, and other hardened photoresists, wherein said organic polymers are selected from the group consisting of polyimides, copolyimides, polyamides, polyamide-imides, fluorinated polyimides, poly(arylenethers), fluorinated poly(arylenethers), perfluorinated alkylene oxides, parylene (N, C, D, or F type), poly(phenylquin-oxalines), poly-naphthalene, poly-fluorinated napththalene, benzocyclobutene (BCB), amorphous fluoropolymers, such as polytetrafluoroethylene, perfluorocyclobutane aromatic ether (PFCB), polynorbornene, and fluorinated carbon, and wherein said substrate consists of at least one portion of a device selected from the group consisting of semiconductor devices and wafers, [ceramic devices,] liquid crystal display devices, flat-panel displays, printed circuit boards, magnetic read/write heads, thin-film read/write heads;

(b) subjecting said organic coatings, films, layers, or residues of step (a) to a precursor chemical or physical treatment prior to step (1) [so as to prepare said organic coatings, films, layers, or residues for exposure to gaseous sulfur trioxide for] capable of facilitating the reaction of said sulfur trioxide with the organic coatings, films, layers or residues to be removed;

(c) carrying out said step (1) so that said water-free, gaseous sulfur trioxide reacts with said organic coatings, films, layers, and residues to form physically or chemically altered organic material;

(d) carrying out said step (2) to remove said altered organic material from said substrates; and

(e) subjecting said organic coatings, films, layers, or residues to a chemical or physical post-rinse treatment subsequent to step (2) [to remove] capable of removing any residual organic material from said substrates remaining after said solvent rinse.